

Pre-quake changes seen in rocks

Scientists have made an important advance in their efforts to predict earthquakes, the journal Nature says.

Wednesday, 9 July 2008

A team of US researchers has detected stress-induced changes in rocks that occurred hours before two small tremors in California's San Andreas Fault.

The observations used sensors lowered down holes drilled into the quake zone.

The team says we are a long way from routine tremor forecasts but the latest findings hold out hope that such services might be possible one day.

"If you had 10 hours' warning, from a practical point of view, you could evacuate populations, you could certainly get people out of buildings, you could get the fire department ready," said co-author Paul Silver of the Carnegie Institution for Science, Washington.

"Hurricane [warnings] give you an idea of what could be done," he told the BBC's Science In Action programme.



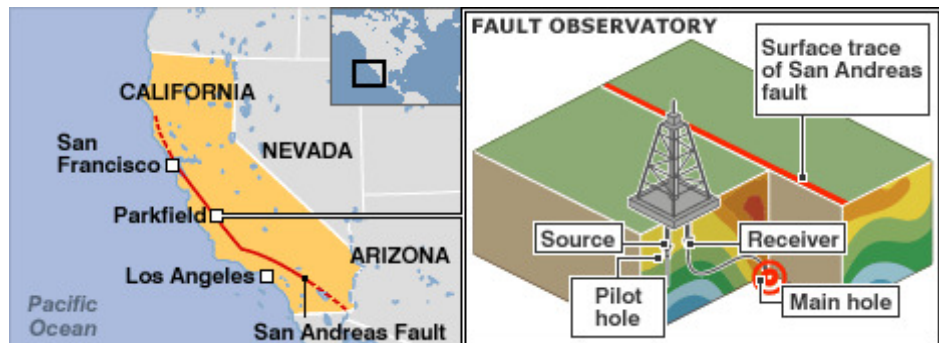
The San Andreas Fault extends almost the full length of California

Speed measurements

The new work comes out of the San Andreas Fault Observatory at Depth (Safod) project which has been set up in Parkfield, a tiny rural town halfway between Los Angeles and San Francisco.

The town experiences small to moderate-sized quakes at regular intervals as the Pacific and North American tectonic plates grind against one another along the San Andreas Fault.

Safod has drilled two holes - a shallow pilot hole, and a deeper hole right into the heart of the shifting rocks. The idea has been to recover sub-surface material for study in the lab and to use instrumentation in the holes to observe changes in the rock over time.



In one experiment, the scientists used a piezoelectric device to generate seismic waves a kilometre down in one hole and then timed their arrival at a receiver seismometer in the other.

"What we're looking for are changes in the velocity that would correspond to changes in stress, and it has been hypothesised that such stress changes would precede seismic events and could be used as precursors," said Dr Silver, explaining that wave speed varies with stress due to cracks opening and closing in the rock.

"For a long time, people have been trying to do this. I think right now the technology has gotten better so we can measure this change more accurately."

'Just enough'

The team - which includes researchers from Rice University and the Lawrence Berkeley National Laboratory - measured significant changes in seismic wave speed just before two small earthquakes.

In one instance, the signal was seen two hours before the quake; in the second, the change occurred 10 hours before the tremor.

The scientists tell Nature that the measurements are an encouraging sign that hold promise for the field of earthquake prediction.

"We are very encouraged by these pre-seismic signals and are planning a series of experiments to expand on them, so that we may further understand their timing and physical basis," said lead author Fenglin Niu of Rice University.

Referring to the 12 May Sichuan quake, which claimed thousands of lives, Dr Niu told the BBC: "What happened in China was that a lot of children were killed in school in their class; so if we can predict earthquakes even by a few minutes, we can help then to evacuate the classroom."



Sensors must be placed deep below the surface to study quakes up close